US. 07/826,754

9102995.9

PATENTS ACT 1977

PATENTS FORM No. 9/77 (Revised 1982)
(Rules 29, 32, 80, 81, 82)

The Comptroller
The Patent Office

REQUEST FOR PRELIMINARY EXAMINATION AND SEARCH OR REQUEST FOR FURTHER SEARCH

NOTES:

1   Paragraph I or paragraph II should be completed by the applicant for a patent according to whether request is made for a preliminary examination and search under section 17(1) or for a further search under section 17(6).

2   Paragraph II should be completed so as to identify the invention in relation to which the further search is being requested. Reference should be made to the claims in which that invention is specified. If this is not done the further search will be made in relation to the second invention specified in the search report previously made under section 17(5).

3   The application number to be quoted should be that assigned to the application when first filed.

4   Attention is directed to rules 90 and 106 of the Patents Rules 1982.

I   I/We ...ROY ROSSER + MARTIN LEACH........

....

....

request the Comptroller to refer my/our Patent Application No. SUBMITTE HERE WITH ....

to an examiner for a preliminary examination and search in accordance with section 17(1) of the Patents Act

1977.   ENTITLED

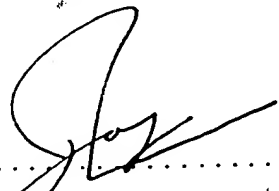"ELECTRONIC BILLBOARD: A METHOD OF ADVERTISING USING EXISTING TELEVISION TRANSMISSION FACILITIES."

II   I/We ....

.... N.A ....

request that, in addition to the search carried out by the examiner in relation to the first invention specified in

the claims of my/our Patent Application No. .... a search shall also be carried

out in relation to the following other invention specified therein , viz.

Signature ....

Y

PATENTS ACT 1977

PATENTS FORM NO. 1/77 (Revised 1982)

(Rules 16, 19)

The Comptroller
The Patent Office

REQUEST FOR GRANT OF A PATENT

THE GRANT OF A PATENT IS REQUESTED BY THE UNDERSIGNED ON THE BASIS OF THE PRESENT APPLICATION

I   Applicant's or Agent's reference *(Please insert if available)*

II Title of invention ELECTRONIC BILLBOARD: A METHOD OF ADVERTISING USING EXISTING TELEVISION TRANSMISSION FACILITIES.

III Applicant or Applicants *(See note 2)*

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.... Country .... State ....

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....

IV Inventor (see note 3)

(a) The applicant(s) is/are the sole/joint inventor(s)

or

(b) A statement on Patents Form No 7/77 is/will be furnished

V   Name of Agent (if any) *(See note 4)*   ADP CODE NO

VI Address for Service *(See note 5)*

13 BAYHAM RD, CHISWICK, LONDON W4 1BG

VII Declaration of Priority *(See note 6)*

Country	Filing date	File number
U.K	14th Feb 1990	9003275.6
U.K		9019770.8

VIII The Application claims an earlier date under Section 8(3), 12(6), 15(4), or 37(4) *(See note 7*

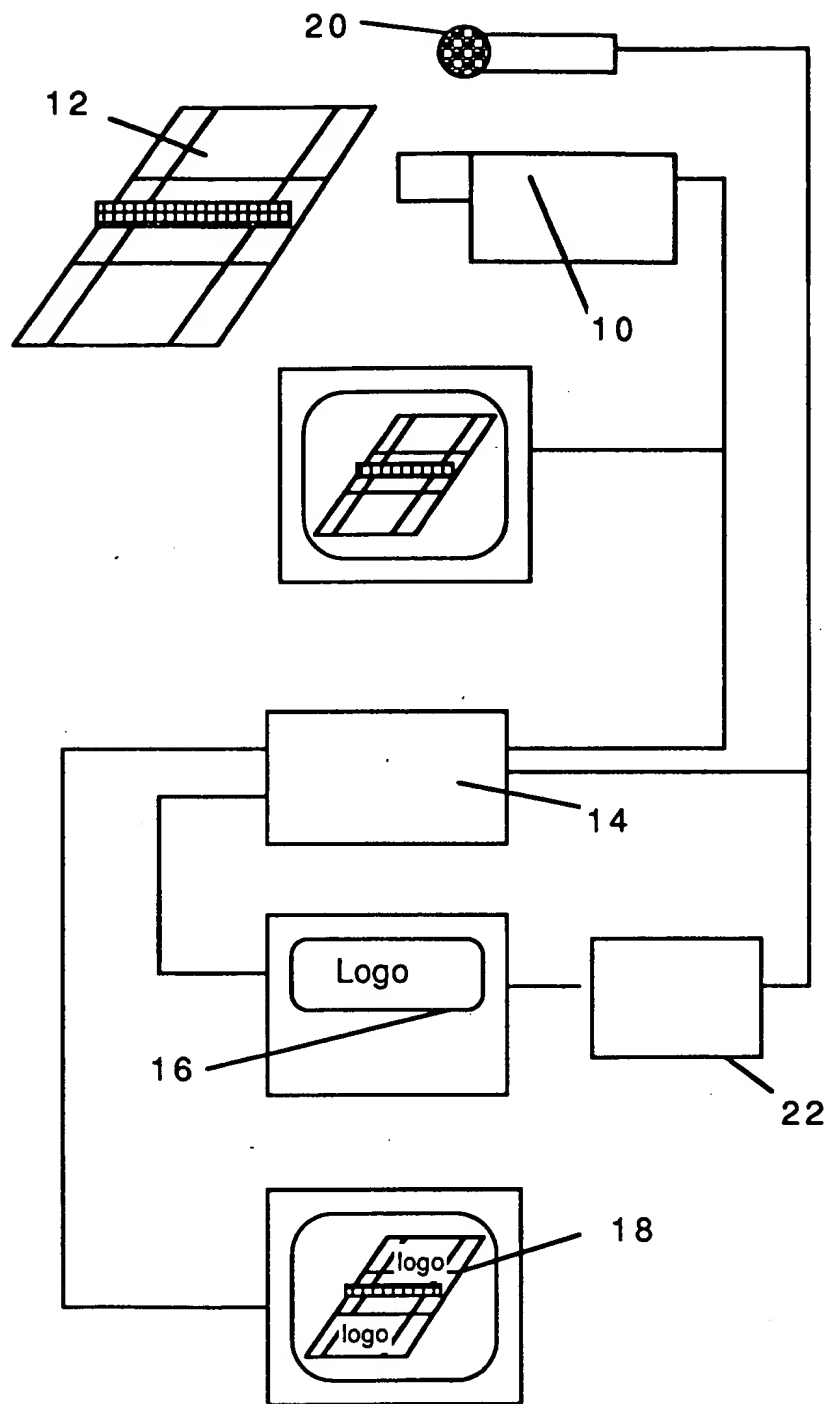20

12

10

14

Logo

16

22

18

logo

logo

Fig. 1

ELECTRONIC BILLBOARD: A METHOD OF ADVERTISING USING EXISTING TELEVISION TRANSMISSION FACILITIES.

This invention relates to a method of advertising using existing television transmission facilities in which the advertiser selects certain areas in a video scene, recognizes these areas using computer based technology, and replaces the selected areas by inserting an image or images of the advertisers choosing. The method of this invention is especially applicable when the recognizing of an area and its subsequent replacement is done in real time, and where the insert is blended into the original video in such a way that it appears real to the television viewing audience. The inserted advertising or messages may have their impact on the television audience enhanced by making them respond, via motion, colour change or other animation, to sound and/or images from the original scene. Although not limited thereto, the present invention is particularly suitable for the display of advertising in live, televised sporting events. It may readily be adapted to all formats of video presentation, including future developments such as high definition television formats.

The essence of the invention is the method of altering video images by selection all or part of an object or objects within a 1st video image, then recognizing that same part or all of an object in each or any of a subsequent stream of video images, and using the position of that object or part of it, as a reference to accurately insert and position a 2nd still or video image into each or any of the stream of video images. The method allows advertisers to add or merge images, messages or slogans to preexisting video images in such a way that they appear to be part of the original image, even when the original video stream is of a live event, being distributed in real time.

Existing technology for merging video images includes the "blue screen" or "chromo-key" techniques, currently used in broadcast industry to show weather forecasters in front of weather maps. In this technology, the presenter is filmed in front of a screen of a particular, pre-defined colour, which is usually blue (hence the name). When merging the two images, the technique amounts to substituting the second image, which in this example would be the weather map, at all points in the first image (the weather person image) where the signal is of the predetermined blue. The method has two short comings. Firstly, the presenter must not have any item on them that is of the blue that will be substituted, else the second image will be merged in at that point, resulting in a weather forecaster who appears to have holes in them.   Secondly, and more important for the

advertising application, there is no correspondence between the two images. They are merely superimposed, which is why weather forecasters make sweeping and general motions when indicating places.

The advertising method of this invention requires very precise positioning of a new image into an existing image. This requires pattern recognition of preselected features, such as the goal posts in a scene of a soccer match. These features can then be used to locate the position, size and perspective of an artificial electronic billboard, which is added to the video image and appears to the end user as if it were part of the original scene. This is described in our application number 9003275.6 to the Patent Office, London, entitled "Electronic Billboard", filed by R.J. Rosser and M. Leach, from which this application claims priority, and subsequent enhancement to that in UK Patent application number 9019770.8.

To effectively apply the method of selection, recognition and substitution to broadcast television of live events, an electronic device is required that detects part or all of an object or objects within a video image, and uses the position of that object or part of it, as a reference to accurately position another still or video image into the original in such a way that the final composite image appears as if it were of the original scene. That is, the added image is seamlessly and realistically incorporated into the original even when the original scene is moved, panned, magnified, zoomed or otherwise alters in size or perspective. All this must be done in real time, or with the processing delay being sufficiently small that it can be applied to events being transmitted live. The most appropriate - possibly the only way - to do this amount of computation on a video image in such a short time with existing or foreseeable technology, is to use the "Burt Pyramid", a well known method of processing, analyzing and/or synthesizing signals described in U.S. Patent application No. 4,674,125 by Dr. Peter J. Burt, entitled "Real-time hierarchical pyramid signal processing apparatus" and discussed in publications such as "Fast Algorithms for Estimating Local Image Properties" by Peter J. Burt, Computer Vision, Graphics and Image Processing 21, 368-382 (1983) and "Pyramid-based Extraction of Local Image Features with Applications to Motion and Texture Analysis" by Peter J. Burt, SPIE, Vol. 360, 114-124.

The "chromo-key" or "blue screen" technology may be useful as an adjunct to the pattern recognition method, being one way of distinguishing non-replaceable, foreground pixels from replaceable, background pixels in certain applications. For instance, when a message is merged on to the field of play of some sport, such as tennis, in most applications it is necessary to make sure that only the tennis court and not the players or their equipment are replaced. This may be done in several ways, one of which is to use

the fact that the court is green, and only replace pixels in the merged image that are within the colour range of the court. Alternate methods of distinguishing between replaceable and non - replaceable pixels include storing an image of the unoccupied court, and subsequently using that as a comparison to determine what is player and equipment and what is background. Differential motion between objects or markings known to be on the court and equipment and players moving over it can also be used as a basis for distinguishing between replaceable and non-replaceable pixels.

The potential uses of such a method of advertising include, but are not limited to, advertising in sporting events such as soccer or rugby where there is continuous action, and no convenient break for the conventional television advertisement. By making the advertising a discrete part of the action, the game would not have to be interrupted. Even in sports where there are breaks for advertising, the method described here is of benefit to advertisers because the message can be displayed while the audience's attention is focussed on the action. It can also be used to enhance such games as American football by artificially including markings for the line of scrimmage and the first down line. Additionally, the message can be changed during the game, it can be animated and it can be different for different target audiences in different locations. Specific examples of applications of the method include, but are not limited to:

- placing advertising in or around the court of play,
- placing advertising on a bowling ball, or a basket ball,
- placing advertising on the bowling ally lane, or parts of a basketball or tennis court, including the backboard of a basket ball court or the net of a tennis court,
- having recognizable patches on individual players in any sport which could then be replaced with advertising, which could be different in different parts of the county or world,
- and special video effects such as "exploding scoreboards" at stadiums where such facilities don't exist.

Although the pattern recognition software using the "Burt pyramid" algorithms is fast, it still takes a finite time to operate. It may, therefore, be important to introduce a time delay into the system. This may be of the order of one or two frames, though it may be longer. This can be done by including a frame store, or other means of temporarily locating a small number of the video screens or frames. The possibility of incorporating a time delay unit into the electronic billboard system is an important part of this invention.

The method of this invention can be further enhanced by allowing the inserted video image to react to some aspect of the original scene, such as the sound. For instance, the inserted slogan could change colour, vibrate or move as the sound level from the stadium reached a certain level. Or it could have a colour which was related to the sound level - a colour "thermometer" of the sound level. In a more sophisticated version, the image change may be keyed to recognition of a particular word by the commentators, using voice recognition software and hardware. For instance the slogan could change when a particular player - or team or when the product name - is mentioned.

Such a system will greatly enhance the effectiveness of electronic billboard method of advertising by linking visual and audio ques. With the development of the appropriate technology the concept can be extended to include visual enhancement of the visual pattern. For instance a sophisticated pattern recognition system may recognize the presence of a particular player and use that to animate or change the inserted image in some suitable fashion. It may also be effective to allow the commentator or other supervisor to control the change in the scene manually, so that it would occur when, for instance, a hoop was scored in a basketball match.

A specific embodiment of the invention will now be described with reference to the attached drawings in which:-

Figure 1 is a schematic view of the technology necessary to implement a version of the electronic billboard method of advertising.

A sporting event is in progress on a field of play 12, which may for example be a tennis match. This sporting event is recorded by means of television cameras 10 and sound equipment 20 for immediate or subsequent distribution to viewers on television sets 18. This distribution of the television signal is done via a suitable transmission and reception system 26, which may be wireless broadcast or a cable network, both of which are well known methods of distributing television signals. Before distribution of the signal to the television sets 18, or at one or more suitable junctures in the transmission chain, the image of the event 12 as recorded by the video cameras 10 is altered to incorporate an advertising message, which may be a slogan or image. Such alteration may take place at the originating site of the event, at a network broadcast center, at a local broadcast center, at a local broadcasting station, at a cable head-end or any other site where video signals are disseminated. This added message is produced by a separate video source 16 which may be a prerecorded video tape, and is merged into the video stream by the image synthesizer

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22 using data from the image analyzer 14 and the frame storage and delay device 20. The essence of this method of advertising is the incorporation of the added message from the secondary source 16 into the main image recorded by the camera 10 in such a way that to the end-viewer looking at the television picture produced on the television 18 the added logo appears as if it were actually on the court 12, even when the camera 10 is panned and/or zoomed to follow the action of the game occurring on the court 12. This seamless merging of the advertising message or image into the video images from the camera 10 is accomplished using the computer-like hardware and software represented by the image analyzer 14, the image storage and delay box 20 and the synthesis and merging box 22. The image analyzer 14, synthesizer 22, delay unit 20, 2nd video source 16 and the audio analyzer 24 taken altogether, constitute the enabling technology or device that needs to be added to existing television transmission systems in order to implement the Electronic Billboard method. Among other features, the image analyzer 14 includes the operator interface equipment (i.e. keyboard, lightpen, and/or hand operated mouse) to allow the operator to select landmarks in the original scene. The image analyzer 14 and synthesizer 22 are electronic or optical processors and/or the software to drive such devices, capable of applying the well known "Burt Pyramid" techniques to the incoming video images in real time. (As described in US Patent 4,674,125, the Burt Pyramid algorithm uses a particular sampling technique for analyzing a relatively high resolution original image in to a hierarchy of N (where N is a plural integer) separate component images, in which each component image is a Laplacian image comprised of a different octave of the spatial frequencies of the original image, plus a remnant Gaussian image. The term pyramid relates to the successive reduction in spatial frequency bandwidth and sample density of each of the hierarchy of component images in going from the highest octave component to the lowest octave component image. The Burt Pyramid is used as it appears to be the most computationally effective method of dealing with visual images that are intended for viewing by humans. Other techniques of video processing may become available that allow the implementation of the Electronic Billboard method of advertising). The technique is used to accomplish three things. Firstly the operator uses the video image of the court 12 taken by the camera 10 to select areas of the court, which may be specific markings such as the tramlines of the tennis court, or the net. These markings are then recognized by the analyzer 14 in subsequent video images of the court 12 and the action occurring on it, and used by the synthesizer 22 to locate, position and orient, including the correct magnification, the logo from the second video source 16 so that it appears to be part of the original scene to the viewers of the television set 18. The logo added from 16 can be made to appear as part of the background - and not interfere with objects or people in the

foreground - by only allowing it to key over specific colours or range of colours, such as the colour of the court in a tennis match. (Or by not keying over specific colours, such as the clothing and flesh colours of the players). The distinction between foreground (which in many applications must not be obscured by the added image) and background (which must be replaced by the added image) may also or alternatively be identified by noise, contrast, or other characteristic of the original image. The resultant effect would be to have an unimpeded view of the match, with advertising discretely, yet conspicuously added. The principle could be extended to use numbers, and other objects, including players themselves, as cues as to where to locate the electronic billboard.

In order to give the analyzer 14 time to process the signal, the signal is feed into the time delay 20, which may be a frame store, or a multi-frame store. The frame store may be any memory medium that has sufficiently fast read/write times. The amount of delay and storage required by 20 will depend on the speed of the analyzer 14 and the quality of the image from the video camera 10. It will be larger for high definition format video than for current broadcast quality video, for instance.

In addition to the video image of the scene 12 recorded by the cameras 10, the sound from the event is recorded by microphones 28 and added to the broadcast stream in the usual fashion. However by linking a suitable audio processor 24 into the audio stream from the microphone 20, the sound can be used to control some aspect of the image inserted by the second video source 16. In the simplest embodiment the audio processor 24 would only respond to the total volume form the microphone 20, and alter the added logo according to that. For instance the colour of the logo could be keyed to the sound level, or the logo could be made to vibrate when the sound intensity reached a certain threshold. This could all be done by software control of microprocessors or by suitable electronic hardware. In a more sophisticated version, the audio processor 24 could be a voice recognition system, as are becoming routinely available. This would recognize, for instance, particular words spoken by say the commentator, and make the inserted video respond in a suitable fashion. For instance, the logo could change colour, do a flip, vibrate move or other wise change whenever the name of a particular player, team or even the product being advertised was mentioned by the commentator. It could even respond to particular words or phrases likely to be uttered by the commentator.

CLAIMS

1   A method of altering video images by selecting part or all of an object or objects within a 1st video image, then recognizing that same part or all of an object in each or any of a subsequent stream of video images, and using the position of that object or part of it, as a reference to accurately insert and position a 2nd still or video image into each or any of the stream of video images.

2.   The method of 1, used for the purposes of advertising on a television distribution system.

3.   A method as in 1 or 2, as performed by an electronic or optical processor and/ or software.

4.   A method as in 1, 2 or 3 in which the electronic or optical device and/or software enables the final, composite image to be such that the inserted image merges with the original and changes shape and hue in the same manner and to the same degree as the original image when it is moved, panned, magnified, zoomed or otherwise alters in size or perspective.

5.   A method as in 1,2,3 or 4 in which the enabling device allows the method to be implemented in real time, and/or with a delay of less than 1 second.

6   A method as in 1,2,3 or 4 in which the enabling device used incorporates a time delay circuit , or stores, allowing up to 10 seconds time for the electronic device to compute the position of the objects and insert the second still or video image into place.

7   A method as in 1,2,3 or 4 in which the enabling device used incorporates a time delay circuit , or stores, allowing up to one minutes time for the electronic device to compute the position of the objects and insert the second still or video image into place.

8.   A method as in 1,2, 3, 4, 5, 6 or 7 in which the enabling device allows the insertion of a multiplicity of still or video images or mixture thereof.

9.   A method as in 1, 2, 3, 4, 5, 6, 7 or 8 in which the enabling device uses colour levels to distinguish non-replaceable pixels, from replaceable, pixels.

10.	A method as in 1, 2, 3, 4, 5, 6, 7 or 8 in which the enabling device uses motion to distinguish non-replaceable pixels, from replaceable, pixels.

11.	A method as in 1, 2, 3, 4, 5, 6, 7 or 8 in which the enabling device uses a previously stored video image of the original scene as a reference to distinguish non-replaceable pixels, from replaceable, pixels.

12.	A method as in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 or 11 in which the enabling device monitors the sound from the original scene or video of it, and uses that to change the inserted or merged still or video image.

13.	A method as in 12 which the enabling device uses voice recognition techniques to make the characterization specific to a particular word or set of words or specific sound.

14.	A method as in 12 in which the enabling device allows a controller to activate the change of the inserted or merged still or video image.

15.	A television or video recording unit or system using a method as described in any or all of claims 1 to 14

16.	A television or video broadcast or transmission unit using a method as described in any or all of claims 1 to 14

17.	A television or video distribution system using a method as described in any or all of claims 1 to 14.

18.	A method substantially as described herein with reference to
Figure 1 of the accompanying drawing.

ABSTRACT

ELECTRONIC BILLBOARD: A METHOD OF ADVERTISING USING EXISTING TELEVISION TRANSMISSION FACILITIES.

This invention is a method of altering video images to enable the addition of images, messages or slogans in such a way that they appear to be a part of the original image. A major use of the method is anticipated to be for advertising, using existing television transmission facilities. The method uses an electronic or optical processor and/or software to select part or all of an object or objects within a video image, and then recognizes that object in a subsequent stream of video images, and uses the position of that object or part of it, as a reference to accurately insert another still or video image into the stream of video images. This is accomplished so that the inserted image is seamlessly and realistically incorporated into the original, even when the original scene is moved, panned, magnified, zoomed or otherwise alters in size or perspective. The resultant composite image appears to the television viewer to all be real.